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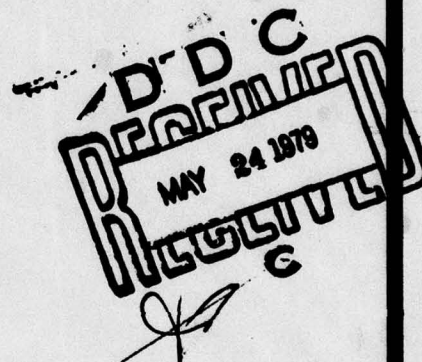
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SOME RELATIONSHIPS BETWEEN THE ABILITY  
REQUIREMENTS AND REWARD ATTRIBUTES OF TASKS

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Research Report No. 23  
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<p>This paper notes that, for the most part, the two major approaches to the study of jobs (to establish ability requirements and to study motivation potential) have not overlapped. It is suggested, however, that changes in jobs for motivational purposes may inadvertently lead to changes in the abilities required for effective performance. The GATB ability requirements and the psychological reward attributes for 140 different jobs were correlated and then replicated on a sample of 79 jobs. Results revealed</p> <p>(continued over)</p>		

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relatively low relationships between the two sets of variables and then primarily for Verbal and Numerical aptitudes and the reward characteristics of Variety and Autonomy. It was also shown that the level of Verbal and Numerical aptitude required by a job is as strongly related to job satisfaction as the level of Variety and Autonomy offered by the job. Some implications for job enlargement and personnel selection are presented.

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SOME RELATIONSHIPS BETWEEN THE ABILITY  
REQUIREMENTS AND REWARD ATTRIBUTES OF TASKS<sup>1</sup>

Benjamin Schneider      John Parkington      Steven B. Mosier

University of Maryland, College Park

The role of tasks in the study of work behavior has long been a focus of intensive research (cf. Hackman, 1969). For the first half of this century, tasks were studied primarily for two reasons which reflected an emphasis on performance outcomes. First, task analysis involved systematically breaking down tasks into components so workers could be taught the most efficient way to accomplish performance objectives (Taylor, 1911). While a process was developed by which tasks (and tools) could be designed for efficient work performance by almost anyone, selection of workers suited to the designed job was also important. Thus, the second reason for the analysis of tasks was to identify the physical and psychological attributes required for effective task performance.

Where the goal is the identification of requisite attributes, procedures for task or job analysis have become quite sophisticated, form the foundation for personnel selection and training systems and are important for a multitude of other concerns in the work context (see McCormick, 1974, for a review of such procedures). The data generated by the more recent quantitatively based procedures have been particularly useful for examining the relationships between jobs and the creation of job

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<sup>1</sup> The authors wish to thank our colleagues Pete Dachler, Hannah Hirsh, Gini Buxton, and Bruce Katcher for their help in the various stages of the preparation of this report. The Computer Science Center of the University of Maryland partially supported the data analyses reported herein.

families. Indeed it seems clear that test validation for job families, as a strategy, is more acceptable as a result of methodologies designed to assess those job families through the clustering of common job elements (cf. Colbert & Taylor, 1978).

In the past 20 years, an alternative approach to understanding the role of tasks in work behavior, the job enlargement focus, has received increasing attention. This strategy focuses on the psychological rewards workers may obtain from tasks (the worker rewards approach to job analysis) rather than the skills workers must bring to tasks for effective performance (the worker requirements approach to job analysis). Early work in this area is represented by Herzberg, Mausner and Snyderman (1959), Argyris (1957), and McGregor (1960) who emphasized the psychological needs and values that can be satisfied by working at specially designed tasks. In addition, these authors maintained that optimum adult development was facilitated in the work setting by the inclusion of psychologically rewarding tasks in the work process.

In relatively quick succession, works such as those by Turner and Lawrence (1965), Ford (1969), and Hackman and Lawler (1971) popularized the role of tasks in worker motivation to the point that an emphasis on task reward attributes is viewed as the "darling" of the 1970's (Hackman, 1975a; see Pierce & Dunham, 1976, and Steers & Mowday, 1977, for reviews). However, Hackman (1975a, p. 130) notes that the attempt to redesign work in ways that capitalize on psychological reward features "seems to be failing at least as often as it is succeeding."

Various explanations have been offered for the failure of job

enlargement or enrichment: (1) individual differences in need strength which impact the motivational effectiveness of the manipulated task attributes (Hackman & Lawler, 1971; Robey, 1974); (2) failure of the organization to fully support the job changes with effective, union/management education (Hackman, 1975b), or inputs of recognition and money (Locke, Sirota & Wolfson, 1976); (3) failure to anticipate the ways job enrichment may impact, or interact with, supervisory style (Lawler, Hackman & Kaufman, 1973); and (4) failure to recognize certain technologies and/or levels of organizational commitment to change which make work redesign of the job enlargement variety simply inapplicable (Sirota & Wolfson, 1972).

It is paradoxical that the worker requirements approach to the study of jobs or tasks has not received research attention as a potential explanation for job enrichment success or failure. Such an approach would build, for example, on the simple idea that as one increases task reward attributes such as variety, autonomy and challenge - i.e., as the task is made more complex (Hackman & Oldham, 1976) - the skills and abilities required for effective job performance might be similarly increased. As Dunham (1977, p. 760) notes: "To most personnel administrators, it is obvious that if the job is changed, the staffing requirements are also changed. However, most job enlargement/enrichment researchers and theorists have failed to consider the impact of job design changes on job ability requisites...."

Dunham (1977) reports the only effort we know which relates worker requirement and reward attributes of tasks. The Position Analysis Questionnaire (PAQ: McCormick, Jeanneret, & Mecham, 1972) was used as a



basis for estimating nine General Aptitude Test Battery (GATB) worker requirement scores. The GATB estimating procedure employs derived equations for combining PAQ job dimension scores into GATB scores. The Job Diagnostic Survey (JDS: Hackman & Oldham, 1975) was used to assess worker rewards. Although the JDS was designed to yield five scores (variety, identity, significance, autonomy, and feedback), Dunham combined these elements into a single measure of job complexity (Dunham, 1976; see also Dunham, Aldag & Brief, 1977).

Both PAQ and JDS data were collected via self-report measures from 256 employees working in a pharmaceutical plant. Data analyses were performed on this total N (i.e., by position) rather than across jobs. Although Dunham (personal communication) reports there were 38 different job titles, each job title appeared to subsume several very different jobs.

Dunham's results revealed that the JDS complexity index was significantly related to all nine GATB scores with r's ranging from .21 (for Manual Dexterity) to .49 (for Verbal Aptitude). Dunham (1977, p. 763) concluded: "... job design decisions should include consideration of possible effects on job ability... requirements in addition to consideration of worker responses."

However, if ability requirements and worker rewards are correlated, it is quite possible that changes in job ability requirements may have the consequence of enriching jobs. That is, theoretically speaking, it is equally plausible to hypothesize increased ability requirements → job enrichment as job enrichment → increased ability requirements.



The critical issue is that these unintended consequences of intervention have received essentially no research attention. This situation makes it difficult to develop specific research hypotheses and equally difficult to specify the ways in which jobs may be changed without generating unintended negative consequences.

From a practical and theoretical perspective, then, it seems important to understand the relationship between requirement and reward attributes of tasks. The present study is similar to Dunham's but attempts to extend his findings by: (a) employing a larger sample of jobs ( $N = 140$  jobs), and a replication sample of jobs ( $N = 79$  jobs); (b) directly coding GATB scores from the Dictionary of Occupational Titles (DOT); and (c) analyzing the separate dimensions of a JDS-like measure of worker reward attributes.

No formal hypotheses were stated as this was basically a descriptive study. However, Dunham's results and some related findings by Greller (Note 1) suggest that positive relationships between the two kinds of attributes should be expected. A more precise determination of which variables in the two domains were related and the magnitude of those relationships were the major foci for this research.

#### Method

##### Sample

This research was part of a larger survey of roughly 850 workers in fourteen organizations (Schneider & Dachler, Note 2). Respondents indicated their job title on their answer sheet. Analysis of these responses revealed 140 different job titles. For each of the 140 different job

titles, at least one respondent completed a JDS-like survey of task attributes; for 79 of the same job titles at least two or more persons completed the survey. Two samples were created, one containing 140 persons in different jobs and the other 79 persons (not included in the first sample) in separate jobs. These are the samples of interest in this article.

#### Procedure

Worker requirements. The job titles written by respondents ranged across all major categories of the DOT including, for example, farm workers, accountants, chemists, clerical workers, managers and janitors. Of this range, 20 different job titles from the survey were randomly chosen and assigned to two coders. Each coder independently located the DOT code s/he thought represented the written job title; there was 80 percent agreement on the precise code for these 20 jobs. The remaining 120 jobs were then coded collaboratively by two persons and the 11 GATB scores associated with a particular DOT code were recorded. The back sample of jobs ( $N = 79$ ) was similarly coded.

Worker rewards. A 26-item survey was developed to assess six facets of tasks: identity, variety, required interdependence, predictability, structure, and feedback. Some examples of items follow:

1. Identity - People can tell from the outcomes of my tasks and duties that I have performed them rather than some other person.
2. Variety - The tasks I work at require me to make different kinds of decisions.
3. Required Interdependence - Getting my task done in this company requires coordinating the efforts of a number of people.

4. Predictability - Supplies needed for my job are available.
5. Autonomy - My task is set up so that I can determine the procedures for getting the work done.
6. Feedback - My task does not allow me to find out how I am doing on the job.

The six a priori scales were patterned after the work of Hackman and Lawler (1971) with segments of many of their original paragraph anchors converted into statements of task conditions or events. Respondents rated each item on how frequently the condition or event occurs in the specific tasks and duties they performed on their job (very infrequently, infrequently, sometimes, frequently, and very frequently). A mark-sense answer sheet was used so respondents did not write in the survey booklet; rather they responded on the answer sheet.

Data analyses. All 850 respondents were assigned one of the 140 DOT job codes and the corresponding GATB scores and then all 850 respondents were grouped by their DOT code. Within each DOT code group, respondents were ordered randomly. The first person holding each DOT code was placed in the front sample ( $N = 140$ ), and when there was a second person with the same DOT code s/he was placed in the back or replication sample ( $N = 79$ ). There were 61 DOT codes for which only one respondent existed and 79 DOT codes with two or more survey respondents. Simple Pearson  $r$ 's were computed between the 11 worker requirement (GATB) scores and the six worker reward scores across jobs within the front sample. This procedure was then repeated in the back sample.

In addition, because there were actually two raters of worker reward attributes for 79 of the DOT-coded jobs in the front and back sample,



an estimate of the interrater reliability for assessing worker reward attributes was calculated. This was accomplished by correlating worker reward scores between the front and back samples across 79 jobs.

It is important to note that jobs, not people, are the targets of these analyses. The obtained results are not intended for generalization to the individual level of analysis. This is true for a number of reasons, the primary ones being: (a) the broad range of jobs studied, no doubt, resulted in unusually large variances, a situation which facilitates observing significant relationships when they really exist; and, (b) the only way to conduct the study on individuals would be to have individual ability profiles.

In the present study, the issue is somewhat unusual in that one set of data, the GATB aptitude scores, are estimated job averages; the worker reward attributes come from individual reports. Recall, however, that the latter data are randomly selected cases where more than one person (in at least 79 jobs) with the same DOT job code responded to the survey. That one person represents an estimate of the data for all others in the same job code.

One could question the logic of using one person for each job code when more than one existed; i.e., why not aggregate or average respondents in order to obtain more reliable estimators of worker reward job scores? The problem with employing this procedure in the present study was the differential number of individual cases for each job code. As previously noted, 61 of the jobs had only one respondent while other job code groups had larger numbers of individuals. Had we aggregated, each job would have had differentially reliable estimators of the job



code group score.

## Results

### Worker Requirement and Worker Reward Relationships

Table 1 presents the intercorrelation matrices for the front sample of jobs (below the diagonal,  $N = 140$ ) and the replication sample of jobs (above the diagonal,  $N = 79$ ). Presented on the diagonal are the KR-14 internal consistency reliability estimates for the six worker reward scales. The KR-14 estimates were calculated on the full  $N \approx 850$ .

With respect to the worker requirement/worker reward relationships, Table 1 reveals reliable relationships exist only between the GATB intelligence, verbal, numerical and clerical aptitudes required for work performance and the worker rewards of variety and autonomy. By "reliable relationships" we mean that the significant relationships tend to be replicated in the two samples. These relationships are not particularly strong ( $r$ 's tend to be between .25 and .35), but they are comparable to the data provided by Dunham (1977, p. 762). Thus, not only have these findings been replicated within the present study, but they also fit well with Dunham's work which partially validates the relationships.

There is one other set of relationships of potential interest in Table 1. First, the DOT code itself positively reflects verbal, numerical and clerical aptitudes but is negatively related to the various physical dexterity issues. Indeed, the intercorrelations of the eleven GATB aptitude scores reveal two clear clusters, one containing academic or "white collar" aptitudes and the other physical aptitudes. As noted above, only the academic aptitudes are consistently related to the

Table 1

## Worker Requirement and Worker Reward Intercorrelations for a Front Sample

(Below the Diagonal,  $N = 140$ ) and Replication Sample (Above the Diagonal,  $N = 79$ ) of Jobs

Worker Requirements	W O R K E R R E Q U I R E M E N T S												W O R K E R R E W A R D S					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
DOT Code	(1) -	52**	56**	48**	-10	-08	56**	-32**	-21*	-38**	-42**	01	27**	-15	-25*	-11	-39**	-03
Intelligence	(2) 52**	-	86**	87**	16	08	48**	-24*	-05	-25*	-15	07	-06	-29**	-17	-01	-44**	09
Verbal	(3) 52**	88**	-	80**	21*	18	55**	-18	-01	-21*	-13	20*	02	-25**	-22*	-06	-47**	02
Numerical	(4) 42**	85**	78**	-	25*	11	57**	-21*	01	-17	-06	17	-04	-23*	-12	-08	-37**	05
Spatial	(5) 07	25**	25**	37**	-	62**	-03	44**	53**	54**	38**	58**	-01	-11	07	08	12	07
Form Perception	(6) 04	18*	23**	26**	74**	-	07	64**	75**	61**	13	55**	09	03	-01	-02	09	-01
Clerical Perception	(7) 43**	53**	57**	61**	01	05	-	-10	04	-17	-21*	-03	03	01	-06	-24*	-37**	-11
Motor Coordination	(8) -18*	-15*	-14*	-10	56**	67**	-14*	-	85**	80**	35**	56**	09	14	26**	12	28**	05
Finger Dexterity	(9) -06	05	05	12	64**	79**	01	86**	-	85**	29**	65**	07	04	15	02	17	-04
Manual Dexterity	(10) -23**	-15	-16*	-09	55**	62**	-18*	80**	85**	-	50**	58**	04	15	17	08	33**	02
Eye-Hand-Foot Coord	(11) -24**	-07	-06	-02	36**	20**	-13	36**	27**	47**	-	27**	-01	04	14	07	30**	13
Color Discrimin.	(12) 12	15*	25**	18*	56**	60**	01	58**	71**	63**	26**	-	10	-05	06	15	01	04
Worker Rewards																		
Identity	(13) -04	-22**	-12	20**	-18*	-19**	-09	03	-11	-04	03	-07	(38)	31**	35**	14	19*	30**
Variety	(14) -13	-35**	-29**	-34**	-31**	-19**	-16*	-03	-12	-01	-05	-22**	43**	(74)	40**	-11	51**	16
Required Interdep.	(15) -02	-11	-09	-05	-02	-08	-07	10	03	13	09	-02	42**	51**	(63)	19*	45**	33**
Predictability	(16) -22**	-11	-07	-05	-04	-02	-11	01	-03	-02	04	04	22**	-06	05	(60)	26**	24*
Autonomy	(17) -20**	-35**	-36**	-37**	-25**	-18*	-21**	-02	-10	-01	07	-26**	43**	52**	31**	15*	(52)	11
Feedback	(18) -01	02	06	09	19**	06	-10	13	03	10	17*	14	35**	13	27**	28**	07	(48)

Note: For Worker Requirements, a low score indicates more of the attribute is required; for Worker Rewards a high score indicates more rewards. Decimals have been omitted. Figures on diagonal for Worker Rewards are KR-14 estimates of internal consistency reliability.

\*  $p < .05$ \*\*  $p < .01$

variety and autonomy reward attributes.

On the measurement side, unreliability in the present measure of worker rewards might be attenuating relationships. In Table 1, the KR-14 estimates of internal consistency reliability tend to be low, ranging from .38 (identity) to .84 (variety). Perhaps more contributory to low correlations are the data presented in Table 2 regarding interrater reliability. As noted above, these correlations were calculated across the 79 jobs for which two raters were available (one per job in each of the samples).

Table 2 is presented as a multitrait - multirater matrix (Campbell & Fiske, 1959) with the diagonal entries representing interrater reliability. As can be seen, the interrater reliability data range from a low of .08 (feedback) to a high of .38 (autonomy); all but feedback, however, are significant. Also note that, for the most part, some convergent and discriminant validity is revealed, as shown by the diagonal entries being typically higher than the off-diagonals. Hackman and Lawler (1971, p. 268) also found feedback to have the poorest interrater reliability, but it is difficult to compare the present results with theirs because they did not calculate employee-employee interrater reliability.

#### Work Satisfaction as a Correlate of Job Attributes

As stated in the introduction, the assessment of job attributes stems from two major traditions, referred to here as worker requirements and worker rewards. Typically, these two types of job attributes have been assessed for different reasons, performance and job satisfaction,

Table 2  
Multitrait, Multirater Matrix for Assessing  
Interrater Reliability for Six Facets of Worker Rewards  
(N = 79 Jobs)

	Iden- tity	Vari- ety	Required Inter- depend.	Pre- dict.	Auton- omy	Feed- back
Identity	(25*)	19	20	-08	19	19
Variety	14	(27*)	28	01	29**	-04
Required Interdependence	17	26*	(37**)	09	30**	08
Predictability	15	03	01	(22*)	12	35**
Autonomy	11	13	06	07	(38**)	19
Feedback	-03	01	-09	06	-06	(08)

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Note: Figures in parentheses indicate interrater reliability. Decimals have been omitted.

\*  $p < .05$

\*\*  $p < .01$



respectively (cf. Lofquist & Dawis, 1969). However, the consistency of the relationships between these two assessments of job attributes lead to some post-hoc thoughts regarding relationships between the ability requirements of tasks and job satisfaction.

In particular, the present finding that 'white collar' ability attributes of tasks (verbal, numerical, clerical) are related to the most frequent reward attribute targets of job enlargement (autonomy and variety), combined with consistent findings regarding white collar job level as a correlate of job satisfaction (cf. Vroom, 1964), leads to the hypothesis that the level of cognitive ability required by a job should be positively related to the job satisfaction experienced.

Table 3 presents the work satisfaction scale of the Job Descriptive Index (JDI; Smith, Kendall & Hulin, 1969) as a correlate of the various worker requirement and worker reward task attributes for the two job samples. This table reveals that, in both samples, the greater the 'white collar' worker requirements, the more satisfied the worker is.<sup>2</sup> Also in both samples, variety and autonomy are the strongest correlates of work satisfaction; however, the other worker reward attributes (except feedback) are consistently and significantly related to work satisfaction. Comparing the two sets of correlations, the results show that 'white collar' worker requirements are as strongly related to work

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<sup>2</sup> These relationships between work satisfaction and worker requirements appear to be independent of job level as indexed by the D.O.T. code. Thus, partial correlations between work satisfaction and worker requirements holding D.O.T. code constant yielded essentially the same relationships as those observed for the zero-order case. The same non-effect was found for relationships between worker rewards and work satisfaction.

Table 3

Work Satisfaction as a Correlate of Worker Requirements  
and Worker Rewards for Two Samples of Jobs

	Front Sample ( <u>N</u> = 140 Jobs)	Bank Sample ( <u>N</u> = 79 Jobs)
Worker Requirements		
DOT Code	-33**	-30**
Intelligence	-50**	-51**
Verbal	-43**	-49**
Numerical	-39**	-44**
Spatial	-22**	-09
Form Perception	-14	-01
Clerical Perception	-23**	-29**
Motor Coordination	04	24*
Finger Dexterity	-09	19*
Manual Dexterity	02	33**
Eye-Hand-Foot Coordination	-02	20*
Color Discrimination	-18*	07
Worker Rewards		
Identity	26**	20*
Variety	49**	51**
Required Interdependence	26**	37**
Predictability	20**	22*
Autonomy	46**	52**
Feedback	12	12

---

Note: For Worker Requirements, a low score indicates more of the attribute is required; for Worker Rewards a high score indicates more rewards. Decimals have been omitted. Work Satisfaction was assessed with the Work scale of the Job Descriptive Index (Smith, et al., 1969).

\*  $p < .05$

\*\*  $p < .01$

satisfaction as are the worker reward task attributes.

One other aspect of Table 3 which requires mention concerns the consistent relationships of the worker reward attributes of identity, required interdependence, and predictability with work satisfaction. This is important because, as revealed in Table 1, these three task rewards are not consistently related to the various GATB worker requirements.

#### Discussion

The seemingly straightforward purpose of the present effort was to examine relationships between two different kinds of task attributes - the kinds of human abilities tasks require for effective performance and the kinds of psychological rewards tasks offer people who work at them. It was reasoned that such relationships may have implications for diverse applications of organizational psychological interventions including job enrichment and personnel selection.

The present findings suggest that, for both job samples, some consistent, significant, but generally modest ( $\bar{r}'s \approx .30$ ) relationships exist between two worker reward attributes (variety and autonomy) and a set of worker requirement attributes typical of white collar jobs - numerical, verbal and clerical aptitudes (the aptitude called intelligence is merely an average of numerical and verbal scores). In addition, a set of post-hoc analyses revealed consistent and quite similar relationships between work satisfaction and the just-mentioned worker requirements and rewards. Finally, it was noted that some worker rewards which are significantly and consistently related to work satisfaction are not related to the various GATB indices of worker requirements.



A clear implication of these data is that job enrichment changes in the variety and autonomy associated with a job may be accompanied by a change in the "white collar" abilities required for effective performance. While at first thought this might be conceptualized as a negative aspect of job enrichment, this is not at all necessarily true. For example, following McGregor (1960, p. 47-48) one might argue that it is precisely the requirement to use such abilities which moves a particular job in the direction of Theory Y. That is, the job becomes one in which the expenditure of effort is natural, people gain self-control, workers become committed to objectives and people learn to accept and seek responsibility because the job requires imagination, ingenuity and creativity allowing for employees to utilize their intellectual potentialities.

Also on the positive side, Schneider (1978) has argued that when tasks are designed so they reward, support and encourage people to work up to their maximum ability, performance levels, work satisfaction and the validity of ability measures will all be improved. Thus, a negative consequence associated with increasing the variety and autonomy in a task may occur primarily when the changes are so dramatic that they lead to demands which are beyond the upper levels of the abilities of job incumbents. Determining exactly where that point is entails estimating, for each incumbent, his/her ability and having existing data regarding how job changes affect ability requirements. The latter kind of data may be generated, for example, through application of the PAQ to the redesigned job, using the derived equations for estimating GATB



requirements (McCormick, et al., 1972) and judging whether the changes in ability requirements are significant for the job incumbent.

A second implication of these data is that there are some task reward attributes which may be manipulable in job enrichment projects that may not result in increased ability requirements. These attributes are identity, required interdependence, and predictability. It should be noted that changes in these task facets might not yield the same kinds of increments in work satisfaction as those to be expected from variety and autonomy. Thus, Table 3 reveals that the relationships between variety, autonomy and work satisfaction are around .50, whereas for the other three attributes the correlations with work satisfaction are closer to .25.

A third implication of these data concerns an issue in criterion contamination regarding the validity of ability measures. Any good manager will take his/her most able people and put them to work on the more critical aspects of jobs. The result of such managerial behavior is that different people in the "same" job are frequently required to use different levels of abilities. The present data suggest the possibility that when people on the "same" job are doing different tasks, the effect of stretching some people to their ability levels may be to motivate them (Hall, 1976). Thus, if some people are doing tasks requiring somewhat more verbal, numerical or clerical ability than others, they may experience their jobs as having more variety and autonomy and, according to Hackman and Oldham (1975) they will be more highly motivated.

If people higher in ability are also more motivated as a result of the management process, then ability tests are also likely to be valid; i.e., high ability people will perform better than those with low ability. Thus, differential placement can impact criterion-dependent validity because of the influence of motivation (see also Bray, Campbell & Grant, 1974).

In summary, these data: (1) Caution against indiscriminant job enrichment efforts directed at affecting changes in levels of variety and autonomy because success in such endeavors may place the job outside the ability domain of the job incumbent; (2) Suggest that GATB ability requirement profiles may provide insight into the kinds of changes jobs can undergo without creating the negative impact of overextending job incumbents; (3) Indicate that the reward characteristics of tasks known as identity, required interdependence, and predictability may be changed without affecting GATB ability requirements and still yield increased levels of job satisfaction; and (4) Suggest that one potential reason for the validity of ability measures in predicting performance is the intrusion of motivation as a result of the placement of more able people on psychologically more rewarding tasks.

## Reference Notes

1. Greller, M. M. DOT job analysis and job quality: A feasibility study. Unpublished paper, Graduate School of Business Administration, New York University, June, 1977.
2. Schneider, B., & Dachler, H. P. Work, family and career considerations in understanding employee turnover intentions. Unpublished ONR Technical Report, Department of Psychology, University of Maryland, College Park, 1978.



## References

- Argyris, C. Personality and organization. New York: Harper, 1957.
- Bray, D. W., Campbell, R. J. & Grant, D. L. Formative years in business: A long-term A. T. & T. study of managerial lives. New York: Wiley, 1974.
- Campbell, D. T., & Fiske, D. W. Convergent and discriminant validation by the multitrait - multimethod matrix. Psychological Bulletin, 1959, 56, 81-105.
- Colbert, G. A., & Taylor, L. R. Empirically derived job families as a foundation for the study of validity generalization, Study III: Generalization of selection test validity. Personnel Psychology, 1978, 31, 355-364.
- Dunham, R. B. The measurement and dimensionality of job characteristics. Journal of Applied Psychology, 1976, 61, 404-409.
- Dunham, R. B. Relationship of perceived job design characteristics to job ability requirements and job values. Journal of Applied Psychology, 1977, 62, 760-763.
- Dunham, R. B., Aldag, R. J., & Brief, A. P. Dimensionality of task design as measured by The Job Diagnostic Survey. Academy of Management Journal, 1977, 20, 209-223.
- Ford, R. N. Motivation through the work itself. New York: American Management Association, Inc., 1969.
- Hackman, J. R. Toward understanding the role of tasks in behavioral research. Acta Psychologica, 1969, 31, 97-128.

- Hackman, J. R. Is job enrichment just a fad? Harvard Business Review, 1975, September/October, 129-138. (a)
- Hackman, J. R. On the coming demise of job enrichment. In, E. L. Cass and F. G. Zimmer (Eds.) Man and work in society. New York: Van Nostrand Reinhold, 1975. (b)
- Hackman, J. R., & Lawler, E. E., III. Employee reactions to job characteristics. Journal of Applied Psychology, 1971, 55, 259-286.
- Hackman, J. R., & Oldham, G. R. Development of the Job Diagnostic Survey. Journal of Applied Psychology, 1975, 60, 159-170.
- Hackman, J. R., & Oldham, G. R. Motivation through the design of work: Test of a theory. Organizational Behavior and Human Performance, 1976, 16, 250-279.
- Hall, D. T. Careers in organizations. Pacific Palisades, CA: Goodyear, 1976.
- Herzberg, F., Mausner, B., & Snyderman, B. The motivation to work. (2nd ed.) New York: Wiley, 1959.
- Lawler, E. E., III, Hackman, J. R., & Kaufman, S. Effects of job redesign: A field experiment. Journal of Applied Social Psychology, 1973, 3, 49-62.
- Locke, E. A., Sirota, D., & Wolfson, A. D. An experimental case study of the successes and failures of job enrichment in a government agency. Journal of Applied Psychology, 1976, 61, 701-711.
- Lofquist, L. H., & Dawis, R. V. Adjustment to work. New York: Appleton-Century, 1969.

- McCormick, E. J. Systematic job analysis. In D. Yoder and H. G. Heneman, Jr. (Eds.) Professional handbook of personnel management and industrial relations, Part 4. Washington, D.C.: Bureau of National Affairs, 1974.
- McCormick, E. J. Jeanneret, P. R., & Mecham, R. C. A study of job characteristics and job dimensions as based on the Position Analysis Questionnaire (PAQ). Journal of Applied Psychology, 1972, 56, 347-368.
- McGregor, D. M. The human side of enterprise. New York: McGraw-Hill, 1960.
- Pierce, J. L., & Dunham, R. B. Task design: A literature review. Academy of Management Review, 1976, 1, 83-97.
- Robey, D. Task design, work values, and worker response: An experimental test. Organizational Behavior and Human Performance, 1974, 12, 315-330.
- Schneider, B. Person-situation selection: A review of some ability-situation interaction research. Personnel Psychology, 1978, 31, 281-297.
- Sirota, D., & Wolfson, A. Job enrichment: What are the obstacles? Personnel, May/June, 1972, 8-17.
- Smith, P. C., Kendall, L. M., & Hulin, C. L. The measurement of satisfaction in work and retirement: A strategy for the study of attitudes. Chicago: Rand McNally, 1969.
- Steers, R. M., & Mowday, R. T. The motivational properties of tasks. Academy of Management Review, 1977, 2, 645-658.



Taylor, F. W. The principles of scientific management. New York:  
Harper, 1911.

Turner, A. M., & Lawrence, P. Industrial jobs and the worker: An inves-  
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